

REMARKS

The non-final Office Action was issued on pending claims 1-6. Claims 1-6 stand rejected. In this Response, claims 3 and 6 have been amended, no claims have been cancelled and claims 7-8 have been added. Thus, claims 1-8 are pending in the application.

Applicants invite the Examiner to call Applicants' Representative to discuss any issues with this application.

Claim Rejections – 35 USC § 102

At Office Action page 2, claims 1, 2, 4 and 5 were rejected under 35 USC § 102(b) as being anticipated by Iijima et al. (JP 11-053967). Applicants respectfully disagree.

Applicants' invention as claimed in claim 1 relates to a polycrystalline thin film. The polycrystalline thin film consists mainly of oxide crystal grains which have a crystal structure of a type C rare earth oxide represented by one of the formulas Y_2O_3 , Sc_2O_3 , Nd_2O_3 , Sm_2O_3 , Eu_2O_3 , Gd_2O_3 , Tb_2O_3 , Dy_2O_3 , Ho_2O_3 , Er_2O_3 , Yb_2O_3 , Lu_2O_3 , and Pm_2O_3 .

Type C rare earth oxide is derived from a fluorite structure of a cubic crystal system and has a structure such that, when eight unit cells of a face-centered cubic structure, as shown in Fig. 3 of the present application, are disposed on one another in the longitudinal and lateral directions, only one of oxygen atoms which have been included interstitially between the lattices constituted from the Y atoms is removed.

For example, in the case of oxide Y_2O_3 , a block of eight Y_2O_3 lattices stacked on one another is regarded as a unit cell, and the lattice constant of the unit cell is 10.6. Therefore, the width of the unit cell is 5.3 Å (0.53 nm), and the distance between the nearest atoms is 3.75 Å (0.375 nm).

The distance of 3.75 Å (0.375 nm) is very close to the distance between the nearest atoms of 3.81 Å (0.381 nm) of the oxide superconducting layer having the composition of $Y_1Ba_2Cu_3O_{7-x}$. The difference between these two distances is 1.5%, and is advantageous in view of crystal matching. Each of the other oxides in claim 1, Sc_2O_3 , Nd_2O_3 , Sm_2O_3 , Eu_2O_3 , Gd_2O_3 , Tb_2O_3 , Dy_2O_3 , Ho_2O_3 , Er_2O_3 , Yb_2O_3 , Lu_2O_3 , and Pm_2O_3 , also exhibits superior crystal matching as well as oxide Y_2O_3 .

In contrast, when a polycrystalline thin film is formed by YSZ (yttrium-stabilized zirconia: $(ZrO_2)_x(Y_2O_3)_y$), the distance between the nearest atoms is 3.63 Å (0.363 nm), and the difference from that of the oxide superconducting layer is 4.5%, which is much larger than those of the above oxides.

The type C rare earth oxide structure is characteristic in M_2O_3 type oxide (M is a rare earth metal), and YSZ crystals cannot have a type C rare earth oxide structure.

When producing a polycrystalline thin film of Y_2O_3 having a type C rare earth oxide structure on a polycrystalline substrate, the following conditions are necessary:

- i) the temperature of a polycrystalline substrate is in a range from 250 to 350°C,
- ii) the energy of an ion beam is in a range from 135 eV to 175 eV, and
- iii) the incident angle of the ion beam irradiating the film forming surface of the polycrystalline substrate is in a range from 50 to 60 degrees.

As shown in the following Table 1 (see page 37 of the present specification), it is necessary to set the ion beam energy in a range from 135 eV to 175 eV and to set the substrate temperature in a range from 250 to 350°C.

Table 1

Ar ⁺ energy (eV)	125	135	150	175	200	300
Substrate temperature						
500°C			×		×	
400°C			×			
350°C			30°			
300°C	×	30°	26°	30°	×	
250°C			30°			
200°C			×		×	
100°C			×		×	

Turning to Iijima et al. (JP 11-053967), a computer generated English language translation of Iijima JP '967 is enclosed. Iijima JP '967 describes, in paragraph [0011], lines 45 to 49, that the intermediate layer 2 (oriented polycrystalline thin film) is consisted of, for example, yttrium-stabilized zirconia (YSZ), cerium oxide (CeO₂), or yttrium oxide (Y₂O₃), and the intermediate layer is formed on a substrate 1 by the above-mentioned IBAD method.

However, the main subject of Iijima JP '967 is the formation of YSZ film. Therefore, the film forming conditions disclosed in Iijima JP '967 are those conditions for producing a polycrystalline thin film of YSZ, not for Y₂O₃. Iijima JP '967 fails to disclose the above conditions i) and ii) for producing a polycrystalline thin film of Y₂O₃ having a type C rare earth oxide structure on a polycrystalline substrate. Regarding condition i), the temperature of a polycrystalline substrate during formation of a polycrystalline thin film layer is not mentioned at all in Iijima JP '967. Regarding the energy of an ion beam in condition ii), Iijima JP '967 only states as only one example, in paragraph [0024], that the assistant voltage of the ion source was set to 300V. The assistant voltage of 300V corresponds to an energy of the ion beam of 300 eV. Although the energy of the ion beam of 300 eV is suitable for the production of YSZ polycrystalline thin film, it is not suitable for the production of Y₂O₃ polycrystalline thin film having a type C rare earth oxide structure. This is clear from the above Table 1 of the present specification. If a Y₂O₃ thin film is formed with an energy of ion beam of 300 eV, the obtained Y₂O₃ thin film should be an amorphous film instead of a polycrystalline film having a type C rare earth oxide structure.

Therefore, based on the disclosure of Iijima JP '967, it is not possible to form a polycrystalline thin film of Y_2O_3 having a type C rare earth oxide structure on a polycrystalline substrate.

Furthermore, Iijima JP '967 is completely silent about a type C rare earth oxide represented by one of the formulas Sc_2O_3 , Nd_2O_3 , Sm_2O_3 , Eu_2O_3 , Gd_2O_3 , Tb_2O_3 , Dy_2O_3 , Ho_2O_3 , Er_2O_3 , Yb_2O_3 , Lu_2O_3 , and Pm_2O_3 .

Therefore, Applicants submit that claim 1 is allowable over Iijima JP '967. Applicants also submit that the claims 2, 4 and 5 are allowable over Iijima '967 for the same reasons that claim 1 is allowable.

Thus, Applicants submit that the § 102 rejections have been overcome.

Claim Rejections – 35 USC § 103

At Office Action page 3, claims 3 and 6 were rejected under 35 USC § 103(a) as being unpatentable under Iijima et al. (JP 11-053967) in view of Iijima et al. (EP 0 872 579). Applicants respectfully disagree.

Applicants submit claims 3 and 6 are allowable over Iijima '967 for similar reasons that claim 1 is allowable as discussed above.

Furthermore, Iijima EP '599 does not provide any additional information for obtaining a type C rare earth oxide represented by one of the formulas Y_2O_3 , Sc_2O_3 , Nd_2O_3 , Sm_2O_3 , Eu_2O_3 , Gd_2O_3 , Tb_2O_3 , Dy_2O_3 , Ho_2O_3 , Er_2O_3 , Yb_2O_3 , Lu_2O_3 , and Pm_2O_3 .

Therefore, Applicants' invention as claimed in claims 3 and 6 is neither disclosed nor suggested by Iijima JP '967 and Iijima EP '579, and are allowable.

Thus, Applicants submit that the § 103 rejections have been overcome.

New Claims

Claims 7 and 8 have been added. Claims 7 and 8 are supported by the specification at page 36, line 19, and at page 7, Table 1. Applicants submit that claims 7 and 8 are also allowable.

CONCLUSION

For the foregoing reasons, Applicants submit that the patent application is in condition for allowance and request a Notice of Allowance be issued.

Respectfully submitted,

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